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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT STATEMENT "A" Approved for public release; Distribution is unlimited.		
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 87-0490			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION ACSC/EDCC	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION			
6c. ADDRESS (City, State, and ZIP Code) MAXWELL AFB AL 36112-5542		7b. ADDRESS (City, State, and ZIP Code)			
8a. NAME OF FUNDING / SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER			
8c. ADDRESS (City, State, and ZIP Code)		10. SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) METHODOLOGIES USED BY WARSAW PACT COUNTRIES (EXCEPT U.S.S.R.) IN					
12. PERSONAL AUTHOR(S) Cheeseman, Robert J., Major, USAF					
13a. TYPE OF REPORT	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 1987 April	15. PAGE COUNT 45		
16. SUPPLEMENTARY NOTATION ITEM 11: OBTAINING U.S. TECHNOLOGIES					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number) The Warsaw Pact countries obtain U.S. technologies by legal and illegal means. Methods of collection include espionage, overt collection, acquisition by scientific and educational exchange participants and illegal trade activities. Examples of methods used by the Warsaw Pact countries (except the U.S.S.R.) are provided. The U.S. faces barriers to preventing loss of its technologies. Among these are resistance from U.S. business interests, insufficient cooperation between U.S. government agencies and overseas allies, lack of U.S. counterintelligence personnel and the openness of American society. The study concludes that the Warsaw Pact has narrowed NATO's qualitative lead in weaponry as a result of the Warsaw Pact's acquisition effort.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL ACSC/EDCC Maxwell AFB AL 36112-5542			22b. TELEPHONE (Include Area Code) (205) 293-2483	22c. OFFICE SYMBOL	



REPORT NUMBER 87-0490

TITLE METHODOLOGIES USED BY THE WARSAW PACT COUNTRIES
(EXCEPT U.S.S.R.) IN OBTAINING U.S. TECHNOLOGIES

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SPONSOR SA JO ANN SHORT, HQ, AFOSI/IVOX

Submitted to the faculty in partial fulfillment of
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METHODOLOGIES USED BY WARSAW PACT
COUNTRIES (EXCEPT U.S.S.R.) IN
OBTAINING U.S. TECHNOLOGIES

MAJOR ROBERT J. CHEESEMAN 87-0490

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PREFACE

This research report was prepared essentially as a briefing paper for Headquarters, Air Force Office of Special Investigations, Technology Transfer Division. It should provide an unclassified yet informative view of the threat to U.S. technologies posed by the Warsaw Pact countries (except the Soviet Union).

I wish to acknowledge the assistance of several people who provided valuable assistance and encouragement in the preparation of this research paper. Among these are my faculty advisor, Lieutenant Colonel Dieter Krause, my faculty instructor Major John Buckner, and the staff of the Air University Library, especially Mrs. Joan Phillips who cheerfully provided direction to my research. Special thanks to my wife Lorraine for her invaluable support.

ABOUT THE AUTHOR

Major Cheeseman enlisted in the Air Force in March 1967. In 1970 he attended Southwest Texas State University under the Airman Education and Commissioning Program (AFIT). Major Cheeseman served as a Special Agent with the Air Force Office of Special Investigations (AFOSI) in Hartford, CT and the Defense Investigative Service at Ft. Meade, MD while on active duty. As a USAF Reserve Officer, he was assigned to AFOSI at Hancock Field, NY and in New York City. In 1980, Major Cheeseman was recalled to active duty as Commander, Detachment 9, 3314 Management Engineering Squadron, Laughlin AFB, TX. He then served as Chief, Officer Procurement Branch, 3511 USAF Recruiting Squadron in Pittsburgh, PA. From March 1983 until July 1986 Major Cheeseman was assigned as Operations Officer, 3514 USAF Recruiting Squadron in New York City. Major Cheeseman holds a B.S. degree in Law Enforcement and History (Honors) from Southwest Texas State University and a Master of Business Administration degree from New York Institute of Technology. He is a distinguished graduate of Air Force Officer Training School, and a graduate of Squadron Officer School. He also completed the Air Command and Staff College correspondence course in 1981.

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EXECUTIVE SUMMARY

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REPORT NUMBER

87-0490

AUTHOR(S)

MAJOR ROBERT J. CHEESEMAN, USAF

TITLE

METHODOLOGIES USED BY WARSAW PACT
COUNTRIES (EXCEPT U.S.S.R.) IN OBTAINING
U.S. TECHNOLOGIES

I. Purpose: To show the nature of the threat against U.S. technologies posed by the Warsaw Pact (except the U.S.S.R.); to provide examples of methods used; to explain some of the barriers that prevent control of U.S. technology losses; and discuss the impact on U.S. national security.

II. Objectives: To explain why the loss of U.S. technologies to the Warsaw Pact is an important issue; to identify the nature of the technology gathering apparatus; to explain methods used and cite examples; to provide some examples of barriers that exist to controlling the flow of U.S. technology to the Warsaw Pact; and to illustrate that their collection efforts impact on the U.S. and NATO military forces.

III. Discussion: The acquisition of U.S. technologies by the Warsaw Pact saves the Soviet Bloc billions of rubles in research and development, reduces their weapons systems procurement times, enhances their defense industries productivity, and reduces engineering risks in developing new weapons. Annually the Warsaw Pact acquires 6,000 to 10,000 pieces of hardware and more than 100,000 documents. In the past six to seven years it is estimated that they have saved \$12 to \$15 billion in research and development

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and from 5 to 7 years in R&D lead time.

Under the direction of the Central Committee of the Communist Party, USSR, annual technology requirements are compiled and disseminated throughout the Warsaw Pact for legal and illegal collection. All Pact countries are tasked by the Soviets to obtain U.S. and other Western technologies. Numerous methods for obtaining technologies have been documented. Examples of Warsaw Pact collection methods can be found in each of 4 broad categories: espionage; overt collection; acquisition by scientific and educational exchange participants; and illegal trade activities.

The U.S. has experienced barriers in preventing the loss of its technologies to the Warsaw Pact. U.S. business interests conflict with export controls. This leads to resistance to compliance regulations. Problems of coordination within the U.S. government and with allies have hindered controls also. Further, insufficient U.S. counterintelligence personnel and the nature of America's open society act as barriers to controlling the loss of U.S. technologies.

Lost technologies impact on U.S. national security. Losses reduce NATO's traditional qualitative edge while improving the Warsaw Pact arsenal. Congressional hearings have demonstrated that more than 150 Soviet weapons systems were derived from Western technology. Numerous examples of Warsaw Pact weaponry can be traced to U.S. designs and equipment. With a 2:1 advantage in manpower and equipment they have also added some of the most sophisticated, up-to-date technologies.

IV. CONCLUSION: The Warsaw Pact has narrowed NATO's qualitative lead in weaponry while maintaining its quantitative lead in manpower and in weapons production. They have prioritized their technology needs, organized their acquisition apparatus, and coordinated their efforts with successful results. The U.S. has taken some actions to control the loss of its technologies but continued action is required.

V. RECOMMENDATIONS: The U.S. must further limit access to design, engineering, and manufacturing methods of critical technological processes. It should rigidly control the most militarily critical technologies by imposing tighter security

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measures and security clearance procedures for contractors. Stiffer penalties for illegal trade activities in the U.S. and abroad are also required. The number of Eastern Bloc representatives in the U.S. must be limited and their freedom of travel restricted and monitored. This can be done with an increase in U.S. counterintelligence personnel. Additionally, if only similarly qualified individuals participated in East-West scientific and educational exchanges, U.S. vulnerabilities could be reduced. Other studies should be undertaken to determine the appropriateness of these and other solutions. A firm commitment by the U.S. and its allies is needed to halt the flow of critical U.S. technologies.

Chapter One

INTRODUCTION

THE THREAT-AN OVERVIEW

The United States is faced with loss of its technologies to the Warsaw Pact because of an enormous acquisition effort launched by the Soviets. The loss of these technologies could not only result in the inability to adequately defend Western Europe but also ourselves. The challenge is immense! Led by the Soviet Union, the acquisition of U.S. technologies and know-how by legal and illegal means has made a significant contribution not only to the Soviets but to the entire Warsaw Pact.

We will see that the Warsaw Pact has a well organized apparatus for obtaining U.S. technologies. Directed by the highest levels of the Soviet Communist Party and government, this extensive network includes the Warsaw Pact nations and their intelligence services. Their aim is to acquire U.S. technologies i.e. the equipment, documents, designs, technical data, and know-how that has given the West a qualitative advantage over the Warsaw Pact for many years. With these technologies, the Warsaw Pact has improved its military forces and has begun to alter the military balance. This paper will examine the threat, emphasizing the methodologies used by the Warsaw Pact other than the Soviet Union, in acquiring U.S. technologies.

BENEFITS TO THE WARSAW PACT

The benefits include: savings of billions of rubles, reduced weapon systems procurement times, enhanced productivity of Warsaw Pact defense industries, and reduced risks in weapons engineering and development (35:11-16). Together, these benefits enable the Warsaw Pact to better respond to NATO weapons and tactics. "We are only beginning to realize the full scope of that effort. The Soviets annually acquire from the West about 6,000 to 10,000 pieces of hardware and more than 100,000 documents" (26:108). This translates into significant savings in research and development and manpower costs (26:108).

Reduced R&D Lead Time and Costs

In the past 6 to 7 years, it's estimated that the Soviets have saved \$12 to \$15 billion in research and development costs and from 5 to 7 years in research and development lead time (4:11). Since the U.S. and its NATO allies have relied upon a qualitative edge against the superior numbers of men and arms in the Warsaw Pact forces, the East's rapidly developing technology jeopardizes our defensive posture (7:170). "Our intention has not been to match the Soviets weapon for weapon but to build upon our technology advantage to neutralize the Soviet numerical advantage" (35:1-2). Unfortunately, our technical superiority is diminishing as the Warsaw Pact introduces more sophisticated weapons that in many cases have been produced as a direct result of their aggressive acquisition effort. Romania is an excellent example of rapid technical progress based on acquisitions from the West.

Enhanced Productivity

The enhanced productivity of the Romanian defense related industries alone have been impressive since widespread acquisition efforts began around 1966 according to Ion M. Pacepa, former Deputy Director of the Romanian Intelligence Service. Pacepa, one of the highest ranking intelligence officials of the Soviet Bloc to defect to the West, said that over 35% of the inventory and development of Romanian industry was at least in part due to intelligence collection operations. Whole factories in the chemical industry for polystyrene, polyurethane, photosensitive materials, and plastic explosives production resulted. New technologies in high alloy steel, metallic carbides, silicon (sic) semiconductors and integrated circuits also emerged. Also 30% of the components for its nuclear reactors, and 40% of their security systems for the entire nuclear industry were illegally acquired (25:23). Pacepa added, "The ways in which the Warsaw Pact countries acquire Western technological secrets are limited only by the imagination, but the methods are basically the same for each Communist country" (25:7).

Reduced Development Risks

According to the Central Intelligence Agency, the major characteristic of Soviet Bloc acquisition of technologies lies in reverse-engineering and copying of Western military and dual-use equipment. This practice indicates overall Warsaw Pact inability to design, test, and integrate technologically advanced military systems (31:10). Therefore, a major advantage for illegally obtaining U.S. technologies is the reduced risk associated with the engineering of these emerging weapon systems.

THE U.S. RESPONSE

Responding to the threat, the United States seeks to deny the Warsaw Pact the documents, hardware, technologies, and manufacturing know-how that will increase their military strength. "Stopping the Soviets' extensive acquisition of military-related Western technology--in ways that are both effective and appropriate in our open society--is one of the most complex and urgent issues facing the Free World today" (40:170). Further, increased technological gains by the Warsaw Pact pressures the U.S. to increase its research and development expenditures to sustain its lead. Considering national priorities, other than defense, this is a budgetary hardship and political problem for the Defense Department.

The benefits of obtaining U.S. technologies are significant for the Warsaw Pact and therefore it should not be surprising that they are well organized and determined. Chapter two will describe the Soviet dominated apparatus for orchestrating the Warsaw Pact's massive acquisition effort.

Chapter Two

ACQUISITION APPARATUS

AN ORGANIZED EFFORT

The Warsaw Pact's apparatus for obtaining U.S. technologies is very well developed. The modern origins of their coordinated quest for technology can be traced to the post World War II era. We know now that the collection of Western technology is directed by the Central Committee of the Soviet Communist Party and the Council of Ministers of the Supreme Soviet. Annually, the 66 ministries of government, the state committees, and institutes formulate a large number of requirements for the collection of Western technology (5:59). These requirements are compiled into a book, Coordinated Requests for Technological Information, also known as the 'Red Book.' This shopping list details collection requirements into 26 chapters and allows all participants in the acquisition of U.S. technology to know precisely what is needed (6:171).

The Soviets have two primary programs to meet these collection requirements. The first program is designed to raise the technological levels of weapons and military equipment and to improve the technical levels of manufacturing. A second program is organized to acquire relatively large numbers of dual-use manufacturing and test equipment for direct use in production lines (31:2). Among the groups participating in the collection of technology are the Committee on Science and Technology (GKNT), the State Committee for Foreign Relations (GKES) and the Soviet Academy of Sciences (27:--). These and other Soviet organizations have the cooperation of their counterparts in the Warsaw Pact and extensive collaboration between the Soviets and their surrogates exists (35:11-16). In this regard, the particular strengths and expertise of each satellite intelligence service is used with the help of five or six Soviet counselors attached to each satellite intelligence service (27:17). In all, some 190,000 people are employed in this network of scientific and technical information gathering (7:84).

The Military Industrial Commission

The first technology collection program is managed by the Military Industrial Commission (VPK) of the Presidium of

the Council of Ministers, U.S.S.R. The VPK manages Soviet military industry and serves as the processing center for the various collection requirements developed by the ministries, state committees and institutes (31:--). Their efforts are primarily, but not exclusively, through intelligence activities.

...the VPK seeks one-of-a-kind military and dual use hardware, blueprints, product samples and test equipment to improve technical levels and performance of Soviet weapons, military equipment and defense manufacturing equipment... This is done in large part by exploiting and adapting design concepts embodied in acquired equipment and associated documents (31:2).

This reverse-engineering of acquired technologies is fundamental to the Warsaw Pact's implementation of technologies. Analysis of reliable data indicate that in the VPK program the Soviet Bloc intelligence services, i.e. KGB, GRU "and their surrogates among the East European intelligence services are the collectors most often tasked and the most successful" (31:11). These bloc intelligence services acquired 60-70% of all materials collected in the entire VPK program during the 1970s and early 1980s (31:12). Also, these intelligence services were involved in collecting worldwide about 90% of the information that the Soviets judged most significant in hundreds of military research projects (31:12).

Ministry of Foreign Trade

The Ministry of Foreign Trade administers trade diversion activities. With the help of Warsaw Pact intelligence services this ministry obtains dual-use manufacturing and test equipment which are placed on production lines for immediate use. Further, the Ministry of Foreign Trade administers and operates hundreds of foreign trade organizations and firms worldwide (31:20). Over 20 of these Soviet Bloc companies operate in the United States (1:506;6:172). These commercial 'covers' are especially important to the Soviets since the Eastern Europeans have access to parts of the United States that are denied to Soviet officials (1:506).

Eastern European Participation

Should there be any doubt that the Warsaw Pact intelligence services work for the Soviets, the testimony of Virgil Tipanudt, a former Romanian intelligence agent and third secretary in the Romanian embassy in Copenhagen will clarify the point. Tipanudt, who defected in 1975, identified 40 industrial spies in Soviet and bloc embassies in Europe. He stated that as a KGB surrogate agency, the

Romanian service was charged with collecting scientific data in four main fields: recent nuclear technology developments; computer technology; chemical industry technology and pharmaceutical industry scientific data (4:493). Another defector, Zdzislaw M. Rurarz, a former Polish ambassador to Japan, also stated,

... as a former member of the Polish communist party, with over thirty-six years as a government and party official, twenty-five of which were in association with military intelligence, I can say with certainty that the SB (Polish intelligence service) is penetrated and guided by the KGB. The SB is strictly forbidden to wage operations without KGB approval... (1:392).

The entire collection apparatus of the Warsaw Pact is used in a coordinated effort to obtain scientific and technical information. Analysis by the Central Intelligence Agency indicates that the East European intelligence services have possibly been more successful than Soviet intelligence when targeting U.S. defense technologies. This is because the East Europeans are perceived as a lesser threat and not operating in a surrogate role. Also, they have fewer travel restrictions in the United States and some, like the East Germans and the Czechs probably find it easier to operate in the West European cultural and commercial climate where much of their work occurs (31:17). The whole Warsaw Pact acquisition effort relies upon the success of its methodologies. A broad, pervasive program using varied collection methods is described in Chapter three.

Chapter Three

ACQUISITION METHODS

KNOWN METHODS

There are several known methods used by the Warsaw Pact countries to obtain U.S. technologies. The Defense Intelligence Agency has documented legal technology transfer to the Warsaw Pact through: joint ventures; licensing agreements; machinery, equipment and materials sales; scientific and technical cooperation; and Warsaw Pact purchases of complete industrial plants from Western nations (34:120). Chief among the methods of technology acquisition are espionage, overt collection, acquisition by scientific and educational exchange program participants, and illegal trade-related activities (43:2). Only a relative handful of cases have become public knowledge, but they do demonstrate how the Warsaw Pact obtains U.S. technologies. Examples can be found for each of the four broad acquisition methodologies.

Espionage

"According to the FBI, Soviet and Eastern Bloc representatives in this country have increased in number from 384 in 1956 to 557 in 1961 and 2,000 in 1980" (15:8). According to Vice Admiral Edward A. Burkhalter, Director, Intelligence Security Staff, Office of the Director of Central Intelligence, in the past five years (1979-1984), that number has again doubled and is now about 4,000. About one-third are full time intelligence officers (33:1104).

The Soviets do not act alone but task the intelligence services of East European surrogates. Even the Romanian service, whose government has established a degree of independence from the Soviets closely cooperate with Moscow in collection tasking. Romanian political independence does not extend to the intelligence agent (16:1)! Some of these East European services specialize in certain operations. The East Germans, for instance, are good at electronic surveillance and bugging; and the Czechs are used to watch the emigres communities (16:1).

A former CIA counterintelligence official says that emigres, especially if they appear to be dissidents, generally elicit sympathy in industry which reduces

suspicious and improves access... (15:8). Emigres can be placed into sensitive posts for intelligence collection. "That is a built-in entree that all the satellites can use, They prey upon the emigre community..." (15:8). According to Ion Pacepa, the Romanian defector,

Ever since the Bolshevik seizure of power emigres have been used for foreign intelligence purposes. In the Rumanian case, once emigration restrictions were loosened in 1972 in an effort to achieve better relations with the West, more than ten thousand departing citizens were recruited for intelligence purposes. To be sure almost all of them failed to use their secret correspondence codes and simply disappeared from our intelligence network, but some of them, either in need of money or in order to protect relatives left behind, cooperated with the CIE [Romanian Intelligence Service]" (25:15).

In one case, the Hungarian intelligence service tried to recruit a U.S. Army serviceman of Hungarian descent after a visit to his mother in Hungary in 1977. The agent made vague threats to the soldier about his family and future visits back to Hungary. The agent then requested some cooperation in obtaining NATO military secrets. The Hungarian-American soldier reported this contact through Army channels and became a double agent for the U.S. This led to an Hungarian agent, Otto Gilbert, being convicted for espionage in the U.S. in 1982 (32:183).

The importance of emigres in espionage was clearly demonstrated when the Romanian Intelligence Service compiled a complete catalog of native or second-generation Romanians living abroad. This amounted to over 100,000 persons cataloged at substantial expense, but it enabled them to efficiently use emigres in espionage (25:16). The Poles too, have aggressively used espionage as a means of obtaining technology especially inside the United States.

The Polish Intelligence Service (SB) has operated successfully in the United States in recent years. Various agents have operated under commercial cover as representatives of the Polish Ministry of Machine Industry, the Polish-American Machinery Company, and other legally established Polish companies doing business in the United States (1:506). As a result, the Polish Intelligence Service has made important inroads into Silicon Valley (1:506). Two prominent cases are narrated below. The approach is basic but effective.

James Harper, a U.S. citizen and electronics engineer provided dozens of documents to the Poles on U.S. ballistic missile defense programs, ICBM basing modes and related technology. He was enticed by dollars. In 1975 Harper was introduced to operatives with a high-tech shopping list by a fellow Californian. At first he delivered relatively minor low tech information to Polish intelligence agents (28:31;33:918).

In 1980, having divorced his first wife, Harper married the executive secretary to the President of Systems Control, Inc., a company doing research for the U.S. Air Force's missile program. Described as an alcoholic and anorectic, Harper's second wife nevertheless had a security clearance and access to sensitive documents. Before their marriage, Harper began to photocopy important documents from the Silicon Valley headquarters of Systems Control, Inc. Harper then flew to Warsaw to provide details of the Minuteman system to his Polish friends. Two documents turned over to the Poles were highly sensitive, "one was 'Minuteman Defense Study (Final Report)' and another was 'Report of the Task Force on U.S. Ballistic Missile Defense' (5:242). In subsequent contacts, Harper was paid \$250,000 by Zdzislaw Prychodzien of the Polish Ministry of Machine Industry (later identified as an operative of Polish intelligence). Harper was finally arrested before he could return to Poland with 150 pounds of copied documents (28:32).

In another espionage case, William Bell, a radar specialist for Hughes Aircraft Corporation sold information on advanced U.S. radar systems and air-to-air, air-to-surface missile research data to Polish intelligence agents. Bell had been very carefully and professionally cultivated. The tragic death of his son, a painful divorce and deep debt were his vulnerabilities. Over several months, Marian Zacharski, then President of the Polish owned company, Polamco, developed a close social relationship with Bell whereby Bell became relatively dependent on Zacharski for companionship. In the course of that friendship, Bell revealed to Zacharski his financial problems which followed his divorce. Zacharski then offered financial assistance to Bell in return for some names of possible contacts for Polamco machinery sales. Bell received \$11,000 for these names. This set the stage for Bell's recruitment and Zacharski asked for more data. At first Bell furnished only unclassified information but eventually Zacharski asked for more sensitive data. When the apartment complex that both Bell and Zacharski were living in was being converted to condominiums, Bell expressed disappointment to Zacharski that he could not afford the down payment. Zacharski again came to Bell's rescue. Soon Bell was providing documents on the F-15 look-down-shoot-down radar system, the quiet radar system for the B-1 and Stealth bombers, an all-weather radar

system for tanks, an experimental radar system for the U.S. Navy, the Phoenix air-to-air missile, and surface-to-air missile data. For about \$170,000 Bell turned over some of the most critical information in the U.S. technological arsenal (1:196-197;33:172).

Sometimes the East European agents can get Westerners to bring the information to them. Werner Stiller, a former East German intelligence officer, who defected in 1979, provided details of East German intelligence service espionage targeted at the large numbers of Western businessmen attending the annual Leipzig Trade Fair in East Germany. This forum provided an excellent recruiting environment for black-marketeters. Stiller said his former colleagues would travel to the trade fair in specially equipped espionage buses with sophisticated equipment such as minicameras, x-ray machines, directional microphones, and photocopiers to take advantage of every opportunity to seize documents and gather data on the latest technologies (8:173). Some documents and technical data can be more easily obtained through legal means.

Overt Collection

According to Marshal V.D. Sokolovskiy, in his work entitled Soviet Military Strategy,

The painstaking and systematic study of all legal information, its methodical processing and its comparison with data from illegal sources can supply intelligence with very important and detailed information concerning all questions of preparation for war in peacetime. This branch of intelligence activity is just as important as the others (6:120).

It has been reported that the Soviet Bloc acquires roughly 100,000 documents from the West each year and 90% of these are unclassified (31:17). A Strategic Air Command pamphlet on operations security listed 22 different examples of open source information on military affairs available to Eastern Europeans, among these are the Congressional Record, Aviation Week and Space Technology, Military Affairs, Defense Documentation Center unclassified documents, etc... (6:127). For the MX missile system for instance the classified section of major newspapers have provided data on the major and subcontractors for each component of the missile (6:128). Other ads have listed job openings in different defense-related job categories and specific functions within each category. The Sunday, December 4, 1983 edition of the New York Times, for instance, contained two large advertisements indicating openings in the area of sonar and ocean surveillance

including: Manager, Towed Array Development; Manager, Vertical/Bottom Arrays; Manager, Marine Navigation Systems; and Surveillance Systems Engineers (6:128). As innocent as this information appears, when compared and contrasted with other data, it certainly helps in targeting particular U.S. industries and technologies (6:--).

Less visible to the American public, trade journals such as Aviation Week and Space Technology, Defense Electronics, Air Force Magazine, and Defense Systems Review focus in greater depth on specialized topics that have significance for the Warsaw Pact. Moreover, academic and technical journals that deal with a variety of scientific matters, often with direct military applications are available for scrutiny. Journals such as Physical Review concentrate on theoretical issues while Applied Optics and Proceedings of the IEEE discuss more applied issues (6:124). Regular reading of such journals can be significant in what is said and what is obviously missing. When the U.S. embarked on building an atomic bomb, sudden and complete disappearance of articles from Physical Review by the best known nuclear physicists indicated U.S. intentions (6:124).

In January 1985, Secretary of Commerce Malcolm Baldrige stated that the USSR had used the Commerce Department's National Technical Information Service (NTIS) to acquire, 'tens of thousands of scientific and technical studies as well as other strategic information.' Secretary Baldrige noted that NTIS had made available Defense Department analyses of space weapons, chemical warfare, nuclear weapons, computer security, high-technology telecommunications, electronics, computers, and lasers; Energy Department studies on nuclear energy and high intensity physics; and National Aeronautics and Space Administration papers on space and technology (9:13).

The systematic reading and abstracting of thousands of learned journals in the West is an inexpensive way to gather information on the advance of high technology. There are estimated to be 35 thousand of these published in no fewer than 65 languages each year. This yields about 1.5 million articles and papers that have to be read, assessed, summarized, and in some cases translated. While formidable, it is a most efficient approach to obtaining information (5:67). In the aggregate, this type of approach may at best reveal sensitive information concerning U.S. capabilities and at the very least provide direction for future intelligence collection requirements. Often, this means collection by East-West scientific and educational exchange participants.

Acquisition by Scientific and Educational Exchange Participants

Participants in scientific and academic exchange programs have been tasked by their respective Warsaw Pact intelligence services to obtain U.S. technologies. "At least 35 conferences worldwide were identified in the VPK program as potential sources of specific data in the late 1970's to assist in solving military research problems" (31:19). Ion Pacepa, the Romanian defector stated,

Although they do not afford access to highly classified information, such agreements and exchanges with Western scientists and engineers are significant sources of technological information. Just to show how seriously we took these activities, in 1978 more than ninety percent of Rumanian engineers, medical doctors, economists and teachers sent abroad under bilateral accords were intelligence agents; some were even intelligence officers (25:8).

At a conference in Boston, Massachusetts, an East German professor from a Mexican University paid \$15,800 to a U.S. Navy civilian engineer for classified documents (12:79). In testimony before the Committee on Government Affairs, Senator William S. Cohen of Maine gave an example of a Hungarian who headed his country's magnetic bubble memory technology (a microchip hardening process making it combat survivable) who came to the U.S. periodically to do research at leading American universities, observe the findings of others, and attend conferences. Cohen concluded the inevitability of this technical information being incorporated into the Warsaw Pact arsenal (5:272). Trade, especially illegal trade, also plays an important part in the total Warsaw Pact effort.

Illegal Trade Activities

According to the Defense Intelligence Agency, Western technology is transferred via open and mostly legal business arrangements (34:120). It's when this legal activity fails or when it is prohibited that illegal trade flourishes. "Every single contact with Western firms was analyzed.... Every new foreign specialist encountered... was reported, and every transaction was... screened for its technological intelligence potential" according to the former Deputy Director of the Romanian Intelligence Service (25:10).

Illegal trade-related activities have increased dramatically since the era of detente ended and legal Soviet access to U.S. technologies was sharply reduced. These

illegal activities include the use of dummy companies, improper licensing procedures, and diversions (5:Ch 4).

The most successful current strategem involves the establishment of dummy corporations in the United States or Western Europe that purchase or place orders for sophisticated micro-electronic manufacturing equipment. The extremely competitive nature of this industry is sufficient to dull the security concerns of many American firms. This makes it easy for the Soviet selling companies to make a 'buy'. Once in hand, the equipment is shipped or reshipped, sometimes with the knowledge of individuals in the selling companies, to conceal eventual destinations in the Soviet Union or Eastern Europe. Both the KGB and the Warsaw Pact intelligence services are the sole proprietors of these firms specializing in the flow of illegal technological trade (4:369).

Diversions often occur through U.S. and foreign firms willing to engage in profitable impropriety, agents-in-place in the U.S. and foreign firms, or through foreign subsidiaries and licensees of U.S. firms (32:81). The Central Intelligence Agency "has identified 300 firms in more than 30 countries engaged in diverting American high technology to communist countries..." (22:61). The following case portrays a diversion enterprise.

Cotricom, A Trade Diverter.

This case involving Jean Didat, a freight forwarder at Orly Airport in Paris demonstrates the depth of illegal trade activities mounted by the Warsaw Pact. Mr. Didat estimated, from his small office alone, he handled goods worth \$20 to \$25 million a year for several years in traffic toward the Soviet Union and Czechoslovakia. Almost all of it was American high technology material obtained through an intricate series of post office box companies in Liechtenstein and Switzerland using forged, purchased and misappropriated documents, and great amounts of cash. Most of what the Russians and Czechs ordered came direct from U.S. catalogs that they showed to Didat. Payments were then made through accounts in Switzerland and West Germany (29:A1, A6).

Didat was employed by Cotricom, a company managed by Robert Almorì and Joseph Lousky, two Frenchmen that a U.S. International Trade Administration hearing commissioner named in the re-export of American equipment to proscribed destinations. According to the Paris trade register, Almorì was also the majority shareholder in Cotricom. The volume,

size, and complexity of the U.S. equipment flowing through Cotricom was vast (29:A1,A6).

Cotricom served as shipper for two comparable groups. One in France and the other in Switzerland. The Paris trade register shows that Cotricom was created in 1977 just nine months after another shadowy company, Hedera Establishment was incorporated in Liechtenstein. Hedera Establishment was a post office box company that served as an intermediary. It was a considerable success for several years (29:A1,A6).

Both groups, for which Cotricom served as principal shipper, worked under the premise that American technology could be bought legally and with ease on the open market in the U.S. They felt apparently reputable buyers in Western Europe could then purchase these goods without much difficulty. In fact, computer subcomponents and electronic manufacturing and testing systems were sent to Cotricom from Technica Limited, an Arizona company with suspected ties to Mr. Almorì. In at least one instance, an unlicensed Technica shipment was sent to Cotricom for the Hedera Establishment. The administrator who signed the Hedera order blank for that shipment was a French citizen named Felix Constantine Popovitch. Popovitch was also employed as a sales manager for a French subsidiary of General Electric and previously worked in Japan as Far East marketing manager for Fairchild Systems Technology. When questioned by investigators, Popovitch admitted involvement in two orders (29:A6).

The illegal import of a Fairchild Sentry 7 computer worth about \$400,000. eventually brought the Cotricom operation into the open in France (29:A6). Didat said he went to Czechoslovakia to handle the first of two deliveries of this kind of unit. The case broke when officials became suspicious after Almorì convinced a business associate to get him an order blank from C.G.E. Alsthalm, a major French electronics company. With this order blank Almorì could import equipment despite American export controls. Later Almorì asked this associate for another order blank because Almorì was requested to appear at the American Embassy in Paris to prove that the signature on the first purchase order was legitimate. Apparently the order for two Fairchild units worth \$800,000. had raised suspicions. First, because the forged Alsthalm purchase order for a U.S. export permit was uncharacteristically sloppy (and had not been approved by the Commerce Department) and next, because Didat tried to expedite it (29:A6). While the French group associated with Cotricom was revealed, Cotricom's Swiss operation continued.

Cotricom's Swiss Operation.

The Swiss operation, which involved Hedera, had a different method of operation since much of the ordering was done from inside an established Swiss electronics company, Favag S.A., a subsidiary of the Hasler holding group in Bern. According to officials of Hasler, two former Favag employees, the purchasing manager and the administrator, used the company to make orders for American high-technology equipment. The equipment was then sold to a dummy corporation, apparently, for transfer to the East. The equipment ordered by the two former Favag officials included more than \$1 million for three Digital PDP 11/70s (sic) computers (with possible use in missile guidance and the collection of data from satellites) and one \$800,000. VAX 11/780 computer from Data General. This VAX computer was reportedly inspected by Czech engineers in a warehouse near Geneva. The former purchasing manager was described by Hasler officials as Mr. Pierre Andre Randin who lived with a Czechoslovakian born woman previously employed by Favag. In his testimony, Didat drew diagrams showing how a Czechoslovak organization made orders through Hedera that were eventually passed along directly or via Favag to Eler Engineering. Eler Engineering was a small, obscure company founded with about \$50,000 in capital in Switzerland. The company was liquidated and then re-established, also in Switzerland, by Joseph Lousky, co-manager of Cotricom (29:A6).

This Swiss operation fell apart after the disappearance of two American-made machines used in manufacturing micro-circuitry. Shipped to Favag by a U.S. company and resold to Eler the equipment then vanished. A Swiss customs service investigation into the diversion described it as the largest diversion of its kind in Swiss history. A U.S. Commerce Department suspension order cited Mr. Randin and Mr. Lousky conspiring to re-export two projection mask aligners to a proscribed destination. Official investigations in France and Switzerland led to Hedera's demise (29:A1, A6).

The Hedera Establishment in Leichtenstein was dissolved in January 1982 with declared capital of only 15,000 Swiss francs (about \$7,125) and its corporate papers did not explain who paid for its multimillion-dollar accounts. The projection mask aligners, worth about \$500,000. were traced to France and reshipped to an undisclosed destination (29:A1). In other cases, we know smuggled or diverted U.S. technology was shipped to Eastern Europe.

Information Magnetics Case.

The Information Magnetics case showed how easy it is, even for an American company, to get away with high-tech smuggling for a long time. The company was first caught in 1972 and again in 1973 for illegally exporting \$800,000 worth of disc heads, testing devices, and other magnetic recording and reproducing equipment for analog computers. It got off with a warning. The following March it tried again to ship unlicensed similar equipment to its subsidiary in England simply by carrying parts in hand luggage. Once in the United Kingdom, the parts were put into a Bulgarian diplomatic bag and sent to that government's trade organization. In 1974, Information Magnetics exported a ferrite slicing machine to Poland which resulted in the company president pleading guilty in federal court to a violation of export controls. He was fined \$100,000 and the company lost its export rights for five years (5:227-228). D. Frank Bazzarre was also motivated by greed when he knowingly sold proscribed microchips to the Warsaw Pact.

D. Frank Bazzarre, Profiteer.

D. Frank Bazzarre, an engineer, sold microchips used in cruise missiles and antisubmarine warfare equipment to an Austrian firm that resold them at more than \$6.5 million to East Germany, Poland, and the Soviet Union. Bazzarre said that he earned at least \$2.5 million in profits during the three years he illegally exported equipment. He was fined just \$110,000 and sentenced to five years in prison for violating export control laws (19:A1;23:A3). Bazzarre's company, Technics, made and traded equipment used in the manufacture of semiconductor devices and in testing computer memories. His company collected equipment for making and using masks--tools for etching circuits into electronic chips--and sent them to Vienna where they were dispatched to the East. The equipment was on the U.S. Commerce Department's Commodity Control List which required licenses before shipment outside the U.S. Bazzarre simply misidentified the equipment! Before the government caught up to him, Bazzarre's company took in over \$6 million (20:39). Werner Bruchhausen and his associates developed a more elaborate network for illegal export of U.S. technologies.

Werner J. Bruchhausen, Trade Diverter.

According to Customs Commissioner William von Raab,

Werner J. Bruchhausen, a West German millionaire is one of the most important members of a small

fraternity of shady characters who handle most of the transfers of forbidden technology to the Soviet Bloc (13:20;17:3).

California Technology Corporation (CTC) was just one of four companies Bruchhausen organized in 1974. CTC used eighteen other trade names from 1974 until 1980 to conceal its illegal trade activities and on paper, the ownership of these companies changed several times within the company network (4:462;8:33). These companies bought high-technology electronic equipment, peripherals, and components valued at over \$10.5 million. Most of the electronics equipment purchased by CTC were considered strategic commodities and controlled for national security purposes requiring U.S. export licenses (4:462).

The operation worked this way. A CTC company in Europe would receive an order and pass it along to one its American affiliates in the U.S., a legal transaction of one American company selling to another. The strategic equipment would then be "shipped and reshipped--with changing waybill numbers and falsified freight documents--along a tangled international route within NATO, until they finally dropped out of sight of the Western authorities" (8:33). Among items shipped by Bruchhausen were a microwave receiver system, a computer system and semiconductor manufacturing equipment (13:20). CTC made over 300 shipments of proscribed equipment to the Warsaw Pact in its six years of operation. Most of the shipments were sent to West German companies controlled or associated with Bruchhausen. From there, the equipment was reshipped to East Germany, Poland, Hungary, Bulgaria, and the Soviet Union (8:32;13:20). None were properly licensed by the State and Commerce Departments and all used fraudulent U.S. export declarations to pass through customs (13:20).

We have examined some technology acquisition methods that have been used by the Warsaw Pact countries other than the Soviet Union. While known cases are relatively few in number, we can see that the Warsaw Pact countries are intimately involved in obtaining U.S. technologies as part of the coordinated Soviet effort. This effort probes U.S. vulnerabilities and exploits them. Why have the Warsaw Pact countries been able to obtain as much U.S. technology as they have? Chapter four will review some of the barriers we face in controlling the loss of our technologies to the Eastern Bloc.

Chapter Four

BARRIERS TO CONTROLLING TECHNOLOGY LOSSES

BACKGROUND

The U.S. has been hindered in clamping the lid down on technology loss at home and abroad. There are several reasons. First, U.S. business interests are not fully supportive of government efforts to halt the flow of technologies. Profit drives business not national security. Businesses in the U.S. and Western Europe see Eastern Europe as a market. Next, there are problems of coordination between U.S. enforcement agencies, and between the U.S. government and the governments of our allies in stemming the flow of high technologies to the Warsaw Pact. Also, U.S. counterintelligence efforts are insufficient to keep tabs on the official, unofficial and covert representatives of the Soviet Bloc. Finally, our open society provides numerous opportunities for agents of the Warsaw Pact to travel and meet Americans, access our open centers of information such as libraries and universities, and visit American businesses.

"Many companies claim that being patriotic has frozen them out of the world market and has angered their European partners ..." (20:40). We shall see that there are impediments to free enterprise that the U.S. and its allies have imposed that have affected world markets. There are two types of controls on technology exports that could be of significant military value to the Warsaw Pact. These are unilateral and multilateral. A brief look at them is important in understanding why some American business interests resist export controls.

Unilateral Controls

Unilateral controls, such as the Commodity Control List, are those imposed by the U.S. government on either American companies, their subsidiaries abroad, or on foreign companies in the case of the re-export of goods from the U.S. Another unilateral control, the Militarily Critical Technologies List (MCTL), developed by the Defense Department, is integrated into the export control process and forms the basis for denying export licenses. Actually, it is a method to review technologies that may be militarily relevant and therefore should not be transferred into the

Warsaw Pact's military-industrial base. One complaint is that the MCTL "classified list is as large as the Manhattan [New York] Yellow Pages and still growing" (30:22). This unwieldy list "contains products, processes, know-how, arrays of knowledge, keystone equipment and the like" (30:22).

Some U.S. businesses have attacked the Commodity Control list of dual-use technologies. They say that it is interpreted too loosely "giving European companies free range of Eastern markets" while the U.S. government keeps Americans on a "far tighter rein" (20:40). The electronics industry may provide an example of the concern expressed by American business interests.

In 1980, the U.S. exported almost \$22 billion in electronics products.... Imports were \$10.5 billion, leaving a trade surplus of just over \$11 billion. In 1985, however, while total exports had grown to \$32.4 billion, imports were up to \$29.9 billion, leaving a surplus of only \$2.4 billion (20:40).

While not conclusively showing that U.S. export embargoes have caused this slippage, the perception is that American trade decline is a result of too much government interference (20:40). According to Rosemary Smallcombe, Export Manager for Varian Associates, a large electronics company, competitors with easier access to buyers in the U.S.S.R. charge two to three times the free-market price for their products. High profits then allow these companies to undercut the price of their products in the free market creating unfair competition (20:41).

In another rather extreme view, some weapons developers inside the United States--confident that we are ahead in military hardware--believe in the 'eat my dust' school of technology. This group simply feels that by the time a weapons system is developed the Soviets already know about it (21:14). Therefore, export controls are unnecessary.

Multilateral Controls-COCOM

Multilateral controls are those executed by the Coordinating Committee on Multinational Export Controls (COCOM). These controls apply to specific types of technology (20:40). For example, the technology for the design of tools employed in diffusion bonding, a solid-state method for joining metals, would require approval from COCOM if the Eastern Bloc is the export destination (20:40).

COCOM includes the U.S., Canada, Japan and 13 European countries (11:1). Its purpose is to control the export of

militarily relevant technologies to deny the Warsaw Pact access to technology that would increase its military effectiveness. It does this in part by classifying controlled technologies into three categories--direct military use, dual-use, and atomic energy use. This gives COCOM a basis for reviewing the criticality of the technology and helps in determining whether or not it needs to be controlled. Since new weapons depend upon technologies that have civilian application (dual-use technologies), the U.S. and COCOM have identified and attempted to control the transfer of these technologies. Agreements are made jointly and the agreed control definitions carry the force of law or of export control regulation for effective administration and enforcement (11:1).

Limits on COCOM.

Unfortunately, COCOM is not based on any treaty or executive agreement and it has no formal relationship with NATO. National interpretations of COCOM controls lead to differences which result in lost technology. In the case of stretch forming equipment and technology used in aircraft construction, COCOM allowed the technology to be transferred by a French firm while the U.S. government denied an American firm an export license (3:87)! COCOM has other limitations on its effectiveness.

Limited penalties for violators of multinational controls limit the overall effectiveness of this process too. In one U.S. case, a ten year prison term was suspended for a six month sentence, 500 hours of voluntary work plus a company fine of \$100,000. Werner Bruchhausen, organizer of the CTC network which made over 300 shipments of proscribed equipment to the Warsaw Pact was not even prosecuted. Instead, he found refuge in West Germany where his export violations were not regarded as extraditable offenses (8:38). In another case, a Belgian who repeatedly tried to secure American software without a license received only a four month imprisonment (7:130). Compared to the loss of research and development time and expense, and the potential loss of NATO battlefield effectiveness, penalties for violators of export controls have been negligible (7:130;22:68)!

Another problem facing COCOM is how to protect itself against the export or re-export of embargoed commodities from non-COCOM nations to the Warsaw Pact. The U.S. requires licensing but other COCOM members rely on dialogue with non-members to contain exports and avoid diversions (11:2). Even with licensing, we know that technology has been diverted. For instance, in the 1970s, silicon technology was furnished to the Romanians by a French citizen working for an American subsidiary in France (34:21). Also, an

Italian electronics company provided them the technology for growing silicon crystals along with the necessary processing equipment (34:21). If licensing is a weak deterrent, then it is reasonable to assume that dialogue will not stop technology transfer to the East from these non-COCOM members. As long as trade continues between non-COCOM members and COCOM members who do not require licensing agreements, American businesses can claim unfair competition.

RESISTANCE TO CONTROLS

Examples of resistance to U.S. controls on technology can be found in business, academia, and even the government itself. When the Defense Department became increasingly concerned about the flow of sensitive technical information to the U.S.S.R., it imposed tighter restrictions on the flow of this information both domestically and internationally (24:7). Their advocacy of these tighter controls embroiled them in a controversy with the Commerce Department in their role of encouraging trade. As a philosophical and jurisdictional dispute continued through the early 1980s the vigorous acquisition of U.S. technology by the Warsaw Pact continued. Ultimately, the Defense Department views prevailed but during the quarrel technology was lost (22:68).

Equally grave damage to our economic interests can occur from bureaucratic control of science and technology according to William Carey, Executive Officer of the American Association for Advancement of Science (1984).

If the Administration continues on its present course of imposing prior clearance and restraints on the disclosure of the results of unclassified research, in the name of shielding our science from Soviet Bloc imitation, the good that can be done through federal funding can be crippled by an officious bureaucracy (24:7).

Commercial spinoffs of R&D can also be hampered by too much government control surrounding the secrecy of military technology. "When Bell Labs developed the transistor, they quickly went public with the invention for fear of it being classified by the military on national security grounds" (24:7). How many other companies have done the same?

In testimony before the Transfer Technology Panel, Committee on Armed Services, House of Representatives in June 1983, Mr. Larry Hansen, Executive Vice President, Varian Associates, on behalf of the Semiconductor Equipment and Materials Institute, Inc. stated that his "industry

supported export controls on commercial goods and technology when these items have critical military significance..." (32:204). Mr. Hansen disagreed with those who contended "that U.S. exporters are the source--and lax U.S. licensing requirements are the cause--of so-called 'diversion' to the East Bloc" (32:205).

The solution ... is not to tighten the export licensing system ... (but) more effective enforcement is needed to stop surreptitious activity without throttling legitimate trade.

.....
Rather than U.S. firms, the East Bloc has been able to obtain semiconductor equipment and technology through transfers from 1. foreign manufacturers based in non-COCOM countries, and 2. foreign manufacturing companies based in COCOM countries.... Most foreign-based manufacturing companies have subsidiaries operating in the United States. Those subsidiaries have enjoyed exactly the same access to the semiconductor device companies and the associated process technology that the U.S. based equipment companies have had. They use information obtained in the major centers of critical technology in the United States to design and manufacture equipment in their home countries. That equipment is then sold elsewhere, including to the East Bloc (32:206-207).

Mr. Hansen concluded his remarks by stating how vital it is to compete in Free World markets. "To allow new Free-World export controls to isolate us from the world market would not only conflict with the interests of our industry; it would be against the interests of the United States" (32:212). Besides resistance to export controls, insufficient counterintelligence agents limit U.S. responsiveness to controlling technology loss.

LIMITED U.S. COUNTERINTELLIGENCE

Francis J. McNamara, former staff director of the House Committee on Internal Security said the FBI's counterintelligence division reached its peak in 1972 and 1973. Then in 1980, the number of special agents for all aspects of law enforcement was cut from 8,630 to 7,804 (18:2). The cut came despite a request for four years running (1973-1977) for 250 additional FBI counterintelligence agents (18:2). By 1980 it was estimated that the Eastern Bloc intelligence operatives outnumbered FBI agents by about 10 to 1 (15:8). It wasn't until 1982 that Congress appropriated some additional funds to hire more FBI agents but counterintelligence by the FBI was hurt while dramatic increases in Soviet Bloc personnel in the U.S. increased. In 1985 there were twice

as many Soviet spies in the United States as there were in 1980, according to Mr. McNamara (18:2). These Soviet Bloc intelligence agents can take advantage of our open society to obtain U.S. technology.

OUR OPEN SOCIETY

Probably the greatest barrier to withholding technology from the Warsaw Pact is our open society. Access to ideas and a competitive free market economy are fundamental to our economic system. But we also know that Eastern Europeans access our scientific and educational centers, businesses, and libraries. Since most of our advanced technology has both a civilian and military application, it increases the complexity of the problem. Denying access to much of our technological ideas would place a burden on our economic system. Yet, a solution is required that will provide trade-offs between freedom and regulation. The best we should hope for is to limit access to those carefully chosen technologies that are the most critical to our national security.

Chapter Five

IMPACT ON OUR SECURITY

BACKGROUND

Just how costly is the loss of U.S. technologies to our national security? First, if we fail to stop these technology losses to the Warsaw Pact we will further reduce our qualitative edge. The Soviet Bloc has already reduced NATO's traditional lead in military technology, in part by spending more in military research, development, test, and evaluation every year since 1972 (9:7). Further, the Soviets "have structured and modernized its forces so that for the first time Soviet acquisition could tilt the military balance" in their favor (9:7). This makes our heavy reliance on a qualitative edge even more important since the Warsaw Pact now outnumbers NATO by at least a 2:1 ratio in most major categories of tactical ground and air power (9:7). Finally, the Warsaw Pact forces in Central Europe, according to DOD studies, have improved their potential combat effectiveness over 90% in the last twenty years, while NATO forces have improved theirs by less than 40% (9:7;26:109). These differences explain why we should be critically concerned. Facing us from behind the Iron Curtain are weapons developed from our own technologies.

IMPROVED WARSAW PACT ARSENAL

Congressional hearings in 1983 demonstrated that more than 150 Soviet weapons systems were derived from Western technology (4:10). Heinrich Vogel an East-West expert at the Bundesinstitut fur Ostwissenschaftliche und Internationale Studien in Cologne, FRG, "believes that up to 70 per cent of all new Warsaw Pact weapons systems are based on pirated technology" (8:109).

One such weapon is the SS-20 - a mobile intermediate range nuclear missile full of Western technology. The launch vehicles trucking them from site to site in East Germany, Czechoslovakia and the eastern regions of the Soviet Union were designed on IBM computers from New York using software from the Massachusetts Institute of Technology. The nose cones are tipped with a carbon-fibre heat shield developed in New Jersey and - should they ever be fired in anger - their three nuclear warheads will be

guided into Western cities by a gyroscope system constructed with the help of machine tools delivered from Vermont (8:109).

A litany of examples of acquired technology has been provided by Richard N. Perle, Assistant Secretary of Defense for International Security Policy. According to Mr. Perle the Soviet SA-7 surface-to-air Grail heatseeking missile was derived from the U.S. Redeye hand-held antiaircraft missile. Also, the Soviet AA-2 Atoll family of air-to-air missiles are based on the U.S. AIM-9 Sidewinder missiles (32:80).

The Soviet AA-2 Atoll is a one-to-one replica of the Sidewinder system, a perfect carbon copy. It is standard equipment under the wings of the MiG-21 fighter-interceptor. It was an Atoll missile that Red Air Force pilot Colonel I. Shchukov fired into Korean Airlines flight KE-007 when the civilian plane strayed into Soviet territory on 1 September 1983... (8:116).

Mr. Perle further stated that the Soviet Bloc has obtained details of our F-15 look-down-shoot-down radar system, the radar system for the B-1 and Stealth bombers and the Improved Hawk missile. Qualitative improvements in Soviet ballistic missiles, according to the Assistant Secretary, would not have been achieved without acquisition of missile guidance and control technology, such as small on-board computers, from the West. From open literature, he said, the Soviet IL-76 design was based on the U.S. C-141 Starlifter. More examples show the similarities between U.S. and Soviet aircraft designs. For instance, the Soviets used the U.S. B-1 bomber design for the Blackjack bomber. The U.S. B-1 began flight testing in the mid-1970s while the Soviet Blackjack bomber entered flight testing in the early 1980s. Both aircraft operate at supersonic speed and use variable wing technology. In another case, the U.S. YC-14 was developed in the early 1970s but was never placed in production. Rather it was used experimentally to design upper-surface blowing engines, yet the Soviet AN-72 Coaler STOL, its look alike was produced and exhibited at the Paris Air Show in 1979 (32:80)! The U.S. F-18 fighter's fire control radar system design, stolen through espionage, helped develop the look-down-shoot-down radars for the latest Soviet fighters, the MiG-29 and the Su-27 (26:108). "In this technology alone, they [the Soviet Bloc] saved five years of development time with a minimum saving of \$55 million in research costs and 1,000 man-years of scientific research" (26:108).

Other equipment acquired by the Warsaw Pact includes over "three thousand of the most sophisticated minicomputers ... identical to [those]... used by the U.S. Defense

Department and... sufficiently advanced to target nuclear weapons and to direct cruise missiles to their intended targets (4:10). We can list more examples of U.S. technologies obtained by the Warsaw Pact but the evidence provided clearly illustrates the problem facing the U.S. and NATO. Almost as quickly as new Western technology is applied, it is incorporated into the Warsaw Pact arsenal which significantly impacts the military balance.

Effect on the USAF

The narrowing of our qualitative edge over the Warsaw Pact directly impacts on the Air Force. In peacetime, our budget will be stretched to find newer, better weapons sooner than we would have otherwise needed to upgrade or replace existing ones. Since the Air Force already receives over 40% of the Defense budget for Research, Development, Test, and Evaluation (RDT&E), increased funding would be a challenge at best (10:14). Next and certainly more significant, we will be facing a potential adversary who not only has high quality weapons and command, control, and communications capability but who also outnumbers us in weaponry and manpower. Essentially then, if our technology no longer serves as a significant force enhancer, we are left with our tactics and our will to win in a conventional conflict. This is another limitation on our conventional capability and a factor leading to the threat of nuclear escalation. This is why we should be concerned and supportive of efforts to limit Warsaw Pact access to our technologies.

Moreover, aerospace is a particularly volatile and critical element of the overall U.S.-Soviet military competition.... Because the Soviets are likely to pursue further aerospace capabilities in the years ahead Air Force personnel have a special responsibility to protect America's lead in military technology" (10:13-14).

The Continued Impact

The Soviet Union has not closed the technological gap with the West, but neither has it fallen much further behind in an age of rapid technological change. Moreover, innovation has been more successful in some sectors than in others, as a result of political priority. *This is particularly true of the defence sector, where pressure from the Party leaders and management by the military have helped to overcome many of the obstacles to innovation to be found elsewhere in the economy* [emphasis added] (7:173-174).

Further, as the Warsaw Pact continues its aggressive acquisition of U.S. technologies it also continues to outproduce NATO. "In 1982, for example, their factories produced 30 long-range bombers, 1,300 fighter planes and helicopters, 200 ICBMs, 175 intermediate-range missiles and 53,000 surface-to-air missiles" (8:122). This production level perpetuates the Warsaw Pact's two to one weapons advantage! We have now seen the threat, its methods, and its impact on the military balance.

Chapter Six

CONCLUSION

Centrally directed, organized, and effective, the Warsaw Pact continues its acquisition of U.S. technologies. Politically, they have set their priorities to obtain U.S. and Western technologies through open and covert means. Under Soviet direction, the other Warsaw Pact countries are intimately involved in obtaining U.S. technologies, primarily through espionage, overt collection, acquisition by scientific and educational exchange participants, and illegal trade activities. They have organized their efforts and have developed successful methods to squeeze out every bit of information helpful to their cause. The benefits have been far reaching. They include: saving billions of rubles; reducing the inherent difficulties of research, development, and engineering; enhancing their production capabilities, and ultimately producing quality weaponry that face us from behind the Iron Curtain. Despite the growing threat, barriers exist which prevent the U.S. from fully controlling its losses. Unilateral and multilateral controls have been initiated but have met with resistance, primarily from business interests. Other problems also limit control of technologies. Among these are insufficient U.S. counterintelligence agents and the nature of U.S. society. American counterintelligence is overwhelmed by the number and pervasiveness of Warsaw Pact representatives in the U.S. Given the openness of American society, imposing controls that would limit exposure of advanced technologies would also infringe on the competitive free market economy. National security has been threatened by the decline of our qualitative margin over the Warsaw Pact arsenal. They are now prepared to use sophisticated weapons employing the latest U.S. and Western technologies. U.S. actions are needed to stop the technology flow and restore the military balance.

RECOMMENDATIONS

Limiting our technology losses may be possible if we continue to reduce our vulnerabilities. While outside the scope of this paper, the U.S. has begun to respond to the threat with greater enforcement of unilateral controls and by encouraging improved multilateral controls. Further, increased vigilance in the U.S. counterintelligence community and public exposure of the problem have also begun. Some recent U.S. actions include congressional

enactment of a revised Export Administration Act, some revisions to the Militarily Critical Technologies List, changes to the International Traffic in Arms Regulations, and revised procedures for dissemination of Defense Department technical documents (28:10). Continued actions are required.

The United States must further limit access to design, engineering, and manufacturing methods of critical technological processes. It can do this by determining the most militarily critical technologies and imposing rigid security on those considered indispensable for national defense. Tighter security clearance procedures for defense contractor and subcontractor employees; stiffer penalties for illegal trade activities throughout COCOM; and control of Eastern Bloc representatives inside the U.S. by limiting their numbers and their freedom of travel are other means available. Balancing numbers and kinds of participants in East-West scientific and educational exchanges i.e. exchanging participants of comparable backgrounds rather than exchanging U.S. literature students for Hungarian electronics engineers for example should be considered. There are many other potential solutions to limiting the losses of U.S. technologies. It is a formidable task which requires a concerted national and international effort. Technology losses pose a direct and immediate threat to U.S. national security. Only a firm commitment by the U.S. and its allies will halt the flow of critical technologies and restore the delicate military balance!

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